SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

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FRIDAY, SEPTEMBER 4, 1903.

CONTENTS:

The U. S. Marine Hospital Service: DR. WALTER WYMAN 289

The General Efficiency of Technical Education: PROFESSOR W. C. MENDENHALL..... 295

John Elfreth Watkins: MARCUS BENJAMIN.. 300

Societies and Academies:—

The Texas Academy of Science: PROFESSOR FREDERICK W. SIMONDS..... 301

Discussion and Correspondence:—

The International Congress of Arts and Sciences: PROFESSOR R. S. WOODWARD. *Antarctica:* EDWIN SWIFT BALCH..... 302

Shorter Articles:—

Kunzite, A New Gem: PROFESSOR CHARLES BASKERVILLE. *The Toxic Effect of* H *and* OH *Ions on Seedlings of Indian Corn:* DR. FRED A. LOEW. *The Spongy Tissue of Strasburger:* MARGARET C. FERGUSON. *Recent Literature on Triassic Ichthyosauria:* PROFESSOR JOHN C. MERRIAM..... 303

Notes on Physics:—

Interference of Light with Great Path Difference; The Electromagnetic Theory of Matter: W. S. F..... 312

Current Notes on Meteorology:—

March Weather Proverbs; Height of the Sea Breeze; Storms of the Great Lakes; Notes: PROFESSOR R. DEC. WARD..... 314

Botanical Notes:—

Recent Botanical Papers; Another Phytobezoar: PROFESSOR CHARLES E. BESSEY.... 315

Memorial of the late Walter Reed..... 316

Scientific Notes and News..... 316

University and Educational News..... 320

MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

*THE U. S. MARINE HOSPITAL SERVICE.**

GENTLEMEN: I beg leave to express my pleasure in meeting you at this assemblage, called by myself in accordance with section 7, of the act of congress approved July 1, 1902.

What may be the result of these annual conferences time must determine, but certainly we may consider the present, the first annual conference under the law, as a most noteworthy event. For the first time in the history of the United States there has been placed within its statutes, by the act of Congress referred to, a provision looking to harmonious and cooperative efforts in public health matters between the national government and the state governments.

This status has long been desired, but difficult of achievement by reason of our republican form of government. It has been difficult for the national government to extend its influence into state health matters without appearing to infringe upon the states' authority, and it has been difficult for the states, individually or collectively, to seek aid from the government without appearing to surrender authority reserved to them by the national constitution. In the meantime, however, the

* Opening address before the first annual conference of State and National Health Authorities, Washington, D. C., June 3, 1903.

Marine-Hospital Service, now bearing the title of the Public Health and Marine-Hospital Service of the United States, has become so developed and strengthened, and the state health organizations have been so perfected, that a sentiment of respect, one for the other, has been established, finding its expression in this law of 1902, and, in particular, section 7 above referred to.

To my mind the outlook is bright. The great problems to be solved in sanitary affairs; the great work to be done in the suppression, and even elimination, of disease, and the cultivation of health and strength, so that physically, as well as in other respects, the United States may take a leading position among the nations, are propositions which should not be considered impossible of solution, and a proper development under the terms of this law will be an important step in this solution.

One of the most important features of this assemblage is its official character. All of us are familiar with conventions of similar purpose, productive of much useful information but entirely lacking in official significance. Here, however, are assembled the legalized health authorities of the states, representing the practical administrative experience as well as the theoretical and scientific knowledge required in the consideration of public health affairs.

Many of you have devoted the best years of a long professional life to the consideration of the subjects which will come before us, having acquired, in individual instances and on special subjects, unusual knowledge and wisdom.

Combined effort appears to be a distinguishing feature of this new twentieth century. This is seen in nearly all forms of civic and commercial life and even scientific and professional effort. It would seem that when the history of the twentieth century is written there will be lacking those great and single characters looming far above the average, leading, directing or dictating; instead, there will be an elevation of the average, the best individual effort will, neither in purpose nor effect, aggrandize the individual, but will be exerted in connection with other effort of like nature for the establishment of a parity of well-being among all. This, I take it, will be the keynote of our action, bearing constantly in mind the actual results to be attained and being determined to attain them.

To refresh your memory I will now read section 7 referred to, and also section 8, which is somewhat analogous.

It will be seen that section 7 provides for three kinds of conferences. First, the surgeon-general may invite as many of the health and quarantine authorities as he deems necessary, not more than one from each state, territory or District of Columbia, to a conference, whenever in his opinion the interests of the public health would be promoted thereby. Second, a conference must be called at least once a year of all the states, territories and District of Columbia. Third, upon the application of not less than five state or territorial boards of health, quarantine authorities or state health officers, he must call a conference, but in this event only those states joining in the request are to be called.

While the present is the first annual conference. it is not the first conference called under the law. Last January, upon the request of twenty-two states, a so-called plague conference was called to consider the situation in San Francisco. The proceedings of that conference in detail have been transmitted to each of you. The effect of it was undoubtedly very great in

bringing about the present satisfactory status in San Francisco. The object of that conference was specific, but, as you will note, the law providing for the annual conference gives no details. We must assume, therefore, that the intent of the law is that we shall get together, and we are to decide ourselves as to the matters to be considered. It is evident that the conference is advisory in character, without changing in the least the present executive force of this bureau of the Treasury Department.

It seems advisable at the outset, and for a satisfactory understanding of one another, to give a review of the laws and of the organizations relating to the Public Health and Marine-Hospital Service, and to receive in return an account of the same nature from each state delegate.

The laws especially relating to the United States Public Health and Marine-Hospital Service can be found listed in the appendix to the regulations of the service of 1902, and the laws relating to quarantine can be found printed in full in the quarantine regulations of 1903.

Having thus referred to the laws, I propose now to describe the organization of the Bureau of the Public Health and Marine-Hospital Service. For executive administration, the bureau is divided into six divisions, each presided over by an assistant surgeon-general. There is, also, a miscellaneous division, presided over by an assistant surgeon, and the office of the chief clerk. The clerical force numbers about twenty. These divisions are named as follows:

Division of Marine-Hospitals and Relief.
Division of Domestic Quarantine.
Division of Foreign and Insular Quarantine and Immigration.
Division of Sanitary Reports and Statistics.
Division of Personnel and Accounts.
Division of Scientific Research.
Miscellaneous Division.

DIVISION OF MARINE-HOSPITALS AND RELIEF.

To this division are sent all matters relating to the marine-hospitals, 22 in number owned by the service, and to the patients, numbering 58,000, treated annually in these hospitals and in some 110 relief or contract stations. The Purveying Depot, a large building located in New York, is under the direction of this division, to which are also referred all matters relating to hospital supplies, including subsistence, drugs, hospital furniture, surgical instruments and appliances, plans and specifications for hospital construction, and the conduct of the sanatorium for consumptive patients at Fort Stanton, New Mexico, where the service has a sanatory ranch, 56 square miles in area, the buildings of the fort having been placed in perfect condition, the patients in the sanatorium numbering about 150. The scheme for this ranch embraces the removal of consumptives from our hospitals with a view to their improvement or recovery. Quite a large percentage have recovered, a number leave greatly improved, and all who desire can find employment after leaving in the same high, dry and healthy locality. The hospitals are thus relieved from this contagious disease, and the vessels from which they come are subject to inspection and disinfection as to their forecastles or other quarters that have been occupied by known consumptive patients.

DIVISION OF DOMESTIC QUARANTINE.

To this division are referred all matters relating to the national maritime quarantine stations, embracing nineteen complete disinfecting stations and eighteen inspection stations. At the former are hospitals, barracks, disinfecting machinery, steamers

and small boats, all requiring constant care and attention. This division, also, must see to the expenditure of appropriations for new stations, involving purchase of lands, construction of piers and buildings, said construction being generally under the supervising architect of the treasury on plans approved by the bureau and the department; but occasionally the bureau attends to this construction itself. To this division are also referred all matters relating to the quarantine regulations and their interpretation. Matters relating to interstate quarantine and suppression of epidemic diseases are also handled in this division. Quarantine upon the Mexican and Canadian borders is also conducted through this division.

DIVISION OF FOREIGN AND INSULAR QUARANTINE AND IMMIGRATION.

To this division is assigned the management of the national quarantine stations in Hawaii, Porto Rico and the Philippine Islands, the supervision of officers detailed for duty in the offices of the United States consuls in foreign ports, who sign the bills of health with the consuls. At present there are three officers in Japan, Yokohama, Kobe and Nagaski; two in China, Shanghai and Hong Kong; one in Naples, Italy; ten in Cuba, three in Havana, one each at Cienfuegos, Santiago, Nuevitas and Matanzas, and several at sub-ports; four in Mexico, two in Vera Cruz, one at Progreso, and one at Tampico; six in the fruit ports of Central America, namely, Bocas del Toro, Colombia; Port Limon, Costa Rica; Bluefields, Nicaragua; Ceiba and Puerto Cortez, Honduras; Livingston, Guatemala; and Belize, British Honduras.

To this division are also referred all matters relating to the medical inspection of immigrants, a most important function of the service, requiring the detail of a large number of officers.

DIVISION OF SANITARY REPORTS AND STATISTICS.

This division is charged with the preparation of the public health reports, published weekly by the bureau. All matters of a statistical nature are referred to it.

It may be of interest to state that some question has arisen as to whether the work of this division which is authorized both by the law of 1893 and the law of 1902, may not duplicate the work of the Census Bureau, but I am pleased to state that, after conference with the Chief Statistician of the Census Bureau and others connected therewith, it has been found that there need be no duplication or interference by one bureau with the other; on the contrary, each will be helpful to the other. The Census Bureau, in addition to the decennial census, will publish an annual census of mortality and births, but the weekly and monthly reports will be published as heretofore by this bureau, and morbidity reports, which are so much desired and which will require special organization to procure, will be undertaken by the Public Health and Marine-Hospital Service.

DIVISION OF PERSONNEL AND ACCOUNTS.

To this division are referred all matters relating to the personnel of the service, examinations for admission to the corps of commissioned officers; examinations for promotion, appointments and resignations, appointment of boards for the physical examination of officers of the Revenue-Cutter Service. This division has also charge of the bookkeeping of the service.

DIVISION OF SCIENTIFIC RESEARCH.

This division might be better called the Division of Scientific Research and Sanitation. To it are referred all matters relating to the hygienic laboratory. It should be understood that this laboratory, or the staff thereof, is not a part of the bureau proper, though at present located in

the same building. A new building, however, is just completed, located on the grounds of the old Naval Observatory, about half a mile west of the White House on the river bank. Five acres of this tract were turned over from the Navy Department for the establishment of this laboratory. It will give the director of the laboratory great pleasure to arrange with the delegates to this conference to show them this building. The laboratory has an advisory board, consisting of a delegate from the army, not yet named, Dr. Urie, of the navy, Dr. Salmon, chief of the Bureau of Animal Industry; Professors Welch, of Johns Hopkins; Flexner, of Rockefeller Institute; Sedgwick, of the Massachusetts Institute of Technology; Vaughan, of the University of Michigan; and Wesbrook, of the University of Minnesota. Under the law of 1902, three new divisions were added to the laboratory, the Division of Bacteriology already existing. These three new divisions are those of zoology, chemistry and pharmacology. But one of these new divisions has been organized, namely, that of zoology, and the good results of this new organization are manifested in the recent discoveries and published report of the chief of this division, Dr. Stiles, upon the 'Prevalence and Geographical Distribution of the Hookworm.' Bulletins, embodying important results of investigations, are published from time to time under the supervision of the Director of the Laboratory, Dr. Rosenau. It is believed that congress can be influenced to provide for the extension of this laboratory by the erection of new buildings from time to time as the necessity therefor becomes demonstrated.

To this Division of Scientific Research and Sanitation are referred special requests for scientific investigation of special diseases, as for example the recent investigation of the so-called spotted fever in Bitter Root Valley, Montana. The initiatory steps for special investigations of this character are taken in this division, but any prolonged or technical work connected therewith is turned over to the laboratory.

Requests for special investigations of water pollution or local causes for the spread of typhoid fever are referred to this division.

The officer in charge of this division examines all current literature relating to scientific medicine or sanitation and keeps a card index of the same.

MISCELLANEOUS DIVISION.

The Miscellaneous Division has charge of the mailing of all bureau publications, and certain miscellaneous duties relating to the reports of necropsies from the marine-hospitals, the medical examination of claims for benefits on account of injuries received by the crews of life-saving stations, certain matters relating to the annual report, etc.

Under certain bureau orders the operations of these several divisions are coordinated so that the work of one division, when it affects the personnel or duties connected with another division, is accomplished with the full knowledge and acquiescence of the other. There are also two regular bureau boards for the careful consideration of matters referred to them —namely, the Service Board and the Sanitary Board.

YELLOW FEVER INSTITUTE.

There is one other feature of the bureau, assigned to no one particular division, but embracing all, namely, the institute for the study of yellow fever, called the Yellow Fever Institute, with which most of you are familiar. This institute was founded about two years ago for the purpose of

learning all that could be learned about yellow fever, including its etiology, and to bring to this work the aid of all reputable physicians who might desire to take part therein, its membership including, besides the officers of the Marine-Hospital Service, special investigators both in this and foreign countries. It is divided into four sections, the chairman of each section being one of the division officers of the bureau to which, under bureau organization, matters of a kindred nature would naturally come. These, together with the chairman and secretary of the institute, form an executive board to consider, especially with regard to publication, the contributions received from the members. Twelve bulletins have been issued. A thirteenth, and the most important of all, relating to the cause of the disease, is now being printed and will be ready for distribution within a few weeks. This bulletin contains the report of a working party sent to Vera Cruz last summer to investigate and attempt to find the causative agent of the disease. Their work was continued during the winter with the material obtained in Vera Cruz, and gives evidence that progress has been made toward a final result. A second working party of three, two of whom were in the first party, are now in Vera Cruz and vicinity pursuing a continued investigation, and it is the purpose of the institute to continue in the prosecution of this work until successful. This institute embraces new features in the investigation of the cause of a specific disease, and if it proves successful with regard to yellow fever it may be that the new features of organized effort which it embraces will be applied to the investigation of other diseases.

Other important matters engaging the attention of the service are the proposed legislation for the establishment of a national leprosarium in which may be received the occasional cases of leprosy found in the states, which give the local and state authorities so much trouble; also the enforcement of the new regulations relating to the examination and licensing of establishments for the production of vaccine, serums and antitoxin, under the law passed by the last Congress. These regulations go into effect next August.

Mention should also be made of the connection of the service with the International Sanitary Bureau of American Republics, established in accordance with resolutions of the Conference of American States held in the city of Mexico winter before last.

THE MEDICAL CORPS.

Finally, with reference to the service work, I wish to say a few words with regard to the medical corps, consisting of 109 commissioned medical officers received into the corps only after a thorough examination as prescribed by law, appointed first to the lowest grade, and promoted to the higher grades only after further successful examination. The discipline of the corps is military in character, the regulations for its uniforms and government are prescribed by the President, its officers, by reason of unusual responsibilities, continuous medical and surgical care of the large clientele, and by special scientific instruction in its hygienic laboratory, are kept in the van of professional excellence. There are, however, nearly two hundred acting assistant surgeons, some of whose appointments are temporary in character, but a number of whom have been long in service by reason of special adaptability or because the arrangement made with them is necessary in the interest of economy. These officers of the medical corps are stationed in all parts of the United States

and its dependencies, and constitute our reliance not only in the ordinary work of the service but in times of special need.

CONFERENCE ORGANIZATION.

I have deemed it necessary to give this somewhat extended account of the organization of the service, both that our aims and methods may be understood and that I may the more readily explain a proposed method of making these annual conferences of practical utility. It might be advisable to appoint on special committees members of the conference especially interested in the several subjects to be considered by these committees, said committees to remain in organization during the year and to receive for further conference with the Surgeon-General such matters as might be pertinently referred to them by him. The titles of these committees would find their analogues in the several divisions of the bureau. The reports of these committees could be read to the full conference at its annual meeting, and, if adopted by the bureau and the conference, would have a force and influence which would naturally result from the conjoint action of the national and state authorities. I would suggest tentatively the following committees: First, on Scientific Research and Sanitation, second, on the Prevention and Spread of Epidemic Diseases, third, on Morbidity and Mortality Statistics, fourth on State Legislation, fifth, on Education. In addition to these, there might be special committees on certain specified diseases, namely, cholera, yellow fever, plague, smallpox, tuberculosis, leprosy, typhoid fever. To these committees might be committed such resolutions as may be offered here, but the adoption of any resolutions by this conference, it seems to me, should not be until after a report thereon had been made by the special committee to which it is referred.

It is believed that the above plan is at least worthy of trial. It would give real aid and would stimulate the members of the committees in an investigation of the subjects confided to them, and might produce a uniformity of effort, a coordination of work in different parts of the country, which now does not obtain.

WALTER WYMAN.

U. S. PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE.

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*THE GENERAL EFFICIENCY OF TECHNICAL EDUCATION.**

DOUBTLESS when an alumni address became a part of our commencement program, it was intended that it should be directed more especially to you, gentlemen of the graduating class, and should be in the nature of a professional welcome from one of your older brothers. You were to be welcomed into the ranks of the engineering profession by one who, not so very long before, had passed through the same strenuous preparation which you are just finishing and who had since become a successful engineer. Unfortunately, I have no such claim to your attention, having wandered from the true faith in which we are all trained here, and it is, therefore, impossible for us to meet on the common ground of your future labors. Instead, it has seemed a not inappropriate thing for us to examine briefly your past work; more specifically, to consider the general value and efficiency as a preparation for life, of the technical education which old Rose has given you, and to compare its general influence and value with that of the very different, so-called 'liberal' education which the regular college or university gives.

Technical and liberal educational sys-

* Alumni address at the commencement exercises of the Rose Polytechnic Institute, June 11, 1903.

tems have radically different ends in view and proceed by quite different methods. The one is specific and definite, preparing men for special fields of activity; the other broader and more general, aiming to give men good ideals, good ambitions, a properly balanced judgment and well-trained mind—items of equipment which are sure to be useful to any man in any walk of life. It has been said that one trains men to live, the other to earn a living. If we accept this as roughly defining their respective characteristics, then it is evident that a combination of the two is the ideal to be sought after. At present, however, it is usually a question of one *or* the other, and colleges of engineering and of liberal arts are coordinate parts of our universities—a fact somewhat grudgingly admitted by those representing the older learning. I think we shall find good reason for their attitude.

In comparing things so different, it is important to select the best points for comparison, and it is obvious that we need not consider matters of purely technical significance. That is to say, when it comes to designing a bridge, it is evident that as a preparation no amount of Latin or history can be considered as an efficient substitute for a course in graphical statics. But it being impossible to foresee the exact future of any student, there is left considerable scope for general strength and adaptability which even the most technical educational method must take into account and seek to provide for. Comparison between liberal and technical training may well be made, then, as regards just this point, the success with which they fit men to grow and to adapt themselves to new and more exacting conditions. But there is another consideration. Every man owes something to himself and to the community which cannot be paid by even the best executed professional services. He owes it to the community that he should be willing and able to discharge successfully the responsibilities which in one form or another are sure to fall upon him; and he owes it to himself and to the community that he should see more in life and get more out of life than lies within his purely technical horizon. It is, therefore, again appropriate to inquire as to the relative success with which the two educations aid men in satisfying these last-mentioned demands, which are essentially general.

It is usual to conceive of any educational scheme as having two fairly distinct aims, which President Hadley has called training for knowledge and training for power—perhaps an unfortunate choice of words in view of the adage 'Knowledge *is* power.' But the meaning is clear—teaching to *know,* and teaching to *think* and *do.* To these should be added a third, less easy to define—teaching to *appreciate,* that is the cultivation of the tastes. The traditional liberal education of the last century was largely an education for power, that is, the stress was laid on mental discipline, training of the memory and logical faculties as contrasted with the imparting of knowledge. The subjects studied, however, largely classical literature and philosophy, naturally and unavoidably fulfilled in a measure the third requirement above mentioned. The characteristic feature was, nevertheless, the hard drill along certain well-defined lines, the infliction on all students of certain definite tasks. At present, however, a liberal education means quite a different thing. The one-sidedness of the old scheme, together with the great increase in the number of possible subjects of study, has led to what seems an almost equally one-sided development in the other direction—namely, the universal preponderance of elective over required studies. It is as if the college or university should greet the prospective student with the

statement: "Here is our collegiate bill-of-fare; a fine array of courses with which, if you choose properly, you can satisfy your proper appetite and at the same time be disciplined as we know you ought to be disciplined. However, help yourself to what you want—we shall interfere only in case of violent indigestion." In spite of traditions to the contrary, then, and in spite of ample opportunities for hard work, a liberal education may come to consist too largely of the imparting of information and cultivation, with not enough mental discipline, and not enough hard work. Indeed, student opinion, quick to detect a weakness and caricature it, has already adopted the name 'culture-course' for an easy-going snap.

The above à la carte scheme, if you will allow the term, contrasts strongly with the table d'hôte service universally found at technical institutions. These have, by a curious paradox, fallen heir to the rigid disciplinary method of the old schoolmasters. As we all know, there is very little latitude in a technical course, once the general aim of the course is decided upon; much of the work requires a good memory, and more important, clear thinking—and students are forced to do it whether they like it or not. The student, in his laboratory work, is constantly confronted with problems the solution of which develops self-reliance and independence, and there is opportunity for him to try his hand at 'knowledge-making.' There is, therefore, little need to worry about the efficacy of technical training as regards *power*, except in one important particular. Training for *power* aims not at the production of the graduate who shall be most immediately successful in the particular work which he first undertakes, but rather one who shall have, as has been said, the greatest capabilities for growth. This means that principles rather than details should be taught; that an independent, self-reliant grasp of a subject should be given, rather than facility in special methods. The recent graduate, thrown for the first time entirely on his own responsibilities, frequently resents this, and is disposed to argue that he should have been taught all the details of the particular machine he is first called upon to design or the special points of the particular lighting system he first has under his control. But he soon learns the short-sightedness of such a policy. Again, any extended engineering career involves extended and varied intercourse with men; to be successful in this demands character and knowledge of men and institutions. There is little of the formal training of the engineer which directly aims to satisfy this demand; and while it is also true that much of it must come from association rather than from formal teaching, still the value in this respect of a curriculum based on the so-called humanities is amply shown by the output of the English universities and the older and more conservative institutions of this country.

Turning now to the other two groups into which we divided the aims of education, we find, of course, that the technical training is here much less efficient. The knowledge embodied in the course is almost entirely special and technical, such as forms a necessary basis for the discipline already outlined. The general or 'humanities' side may be represented only by a relatively small amount of two modern foreign languages, a little economics or political science and English. A narrow basis, surely, for the broad activities, the general intercourse and the contact with men which are features of a successful engineering career. It is a pity that men whose disciplinary training has been so well calculated to bring out their best abilities, to train them for control and leadership,

should in any way be hampered by a narrow outlook or ambition. It has been said, on the other hand, that since engineers deal more particularly with materials and physical relations rather than with men, it will never be demanded or expected of them that they should have any particular knowledge of men or of human institutions, such as is necessary in other more humanistic professions. In other words, that an engineer will be just as successful whether he be a broad man or a narrow man, since all the public wants him for is to build a bridge or a railroad, or perform whatever other special service he is fitted for. This is too narrow a view, for two reasons: (1) The educational level is rising, and the engineer must at least keep pace with the general improvement. (2) Engineers are taking such an increasingly prominent part in the life of the country—engineering undertakings are so closely allied to questions of public policy, public economy and social order, and the matter of immediate utility is so closely involved with that of permanent value and fitness—that the public can not afford to intrust its engineering undertakings to any but broad men.

If technical training is deficient as regards broad knowledge, it is still more so as regards the culture side, which is left practically untouched. Moreover, there is very likely to be a desire on the part of the students still further to reduce the time spent in such work, the argument being that it is not sufficiently 'practical,' and doesn't 'pay.' I believe it does 'pay,' even in a commercial sense—but what if it does not? Is there nothing there worth having except for the profit it will bring? The word we have used to represent this side of education—culture—is in bad repute even among those representing its best phases. To some it means a veneer, a smattering of music, art or literature; a sort of young-ladies'-finishing-school halo of accomplishments. Again it may imply a somewhat exclusive but genuine learning and an air of condescension toward every-day life and work. Both mistaken notions, of course. What the word should imply is a genuine interest in something for its own sake, and a determination to know and appreciate the best there is of that something—whether it be literature, music, amateur photography or tennis. The broader the interest, the greater the intelligence and the self-sacrificing labor necessary to appreciate and attain the best, just so much broader and more thorough is the culture which it represents. Matthew Arnold put the matter in a compact and surprisingly practical form when he defined culture as 'the disinterested pursuit of perfection'; it is a point of view, an attitude, a motive which has its influence on every action.

It is apparent, then, that technical education as at present understood is strong in the matter of the discipline of the mind and will; it will help a student to think clearly; it will give him self-confidence and self-control, and teach him the virtue of and necessity for work. It is equally apparent that the system is weak on the side of broad general knowledge and cultivation, and there can be no doubt that this is a serious defect. There are three possibilities for improvement. The first is to devote more time during the technical course to subjects of a general character. It is doubtful whether this can be done to any great extent in view of the constantly widening technical field; but I believe some improvement could be brought about, and at least we as alumni should be cautious in urging or suggesting any reduction in the minimum time now allowed. Again, the burden of providing this part of the engineer's education may be pushed down on the preparatory schools. This means

raising the requirements for admission, that is the general as distinguished from the technical requirements. The student's preparation in the high school or academy should be complementary rather than introductory to his later work, those subjects being omitted which will be thoroughly taken up in the college course, in favor of languages and other subjects which can not be so well studied later. But this rearrangement and extension of the preparatory course must not involve any material increase in the entire time required to obtain the bachelor's degree, for our graduates, as compared with those in Germany, are quite old enough under the present arrangement.

Finally, student activities and intercourse which make up the characteristic college life furnish an opportunity of supplying the general training which is lacking. Indeed, if the statements of some over-enthusiastic college presidents be accepted, to the effect that participation in college life is the chief end in attending college, we might logically conclude that the differences between a liberal and a technical education could be entirely made up by the proper introduction of dormitories, fraternities and a reasonable amount of hazing. Without going so far as entirely to deny the value of the regular curriculum, we must admit that intercourse with fellow students and participation in various student enterprises may be of tremendous benefit, if these activities are rightly directed and carried on, and such activities, particularly along lines very different from the routine work, should by all means be encouraged. This encouragement can be the more freely given because student enterprises are far less likely to be carried to an extreme among engineering students than among others, simply because they have less time for such things. This simple fact of having plenty to do, effectively answers, almost before they are raised, many of the questions which are most difficult to deal with in connection with student life at other institutions of a different character. For instance, outdoor sport with you has not entirely ceased to be play, and the view still finds favor that athletics exist for the benefit of the students, rather than that the student body exists to 'root' for a winning team.

In ways like these will it become more and more true, let us hope, that the engineering graduate has had the essential features of a liberal education in addition to his professional training. That such is not the case at present should be frankly admitted. The danger is that the graduate should not realize the limitations of his training, and should not in the future be at all interested in making up its deficiencies; that his judgment as to the values of an education be based too largely on the consideration as to whether or not it 'pays.' Such a one-sided point of view is, I am glad to believe, rare among us. We are all proud of the good name of our alma mater; we appreciate that the rank of an institution is in large measure determined by the success of its graduates; and we are earnest in our endeavor to win such recognition in our specialties as shall be worthy of, and if possible bring additional honor to, old Rose. But do we fully grasp the fact that we are called upon to be broad men as well as specialists, and that there is a sort of success to be attained quite distinct from our professions? I trust that we do, and I hope that the R. P. I., without losing in the least its good repute as a trainer of expert engineers, may more and more be known as a trainer of men.

W. C. MENDENHALL.
UNIVERSITY OF WISCONSIN.

JOHN ELFRETH WATKINS.

THE sudden death in New York city on August 11 of Dr. J. Elfreth Watkins, for many years Curator of Mechanical Technology in the U. S. National Museum, is a severe loss to that institution and, indeed, to the world at large, for his great knowledge of the early history of the beginnings of mechanics, especially in our own country, had made him an accepted authority on such subjects.

Dr. Watkins was born in Ben Lomond, Va., on May 17, 1852, and was a son of Dr. Francis B. Watkins and Mary Elfreth. On his father's side he was descended from Thomas Watkins, who during the War of the Revolution contributed his influence and money towards the raising of a troop of cavalry of which his son became captain. On his mother's side he was descended from Timothy Matlack, 'the fighting Quaker,' who was a member of the Committee on Safety in Pennsylvania, and after participating actively in the War of the Revolution, was a delegate to the Continental Congress during the years 1780 to 1787; also on his mother's side he was descended from John Elfreth, who served in the Philadelphia City Troops in 1814.

Young Watkins received his academic education at Tremont Seminary in Norristown, Pa., and then entered Lafayette College, Pa., where he was graduated in the scientific course in 1871, taking the degrees of C.E. and M.S. For a year after graduation he served the Delaware & Hudson Canal Co. as mining engineer, and then entered the employ of the Pennsylvania Railroad as assistant engineer of construction, being stationed at Meadows Shops, N. J., where he remained until 1873, when he was disabled for further field work by an unfortunate accident that resulted in the amputation of his right leg. On his recovery he was assigned to the Amboy division of the Pennsylvania road, and served in various capacities during the ten years that followed. In 1883 he was appointed chief clerk of the Camden & Atlantic Railroad, and a year later was assigned to a similar office on the Amboy division of the Pennsylvania Railroad, which place he then held until 1886.

The history of the beginnings of mechanical arts in the United States, especially in connection with the development of transportation, attracted his attention and he became a close student of that subject. He soon met the late Dr. G. Brown Goode, a Virginian like himself, and at Goode's suggestion he received an appointment in the National Museum as Honorary Curator of Transportation, which place he accepted in 1884, and at once began the work of organizing that division which now contains some of the most valuable exhibits of the museum.

Two years later he severed his connection entirely with the Pennsylvania road, in order to devote his entire time to the museum, and continued as curator until 1892. The knowledge which he had acquired with special reference to the early history of the Pennsylvania Railroad led to an invitation which he could not refuse, to return to the service of that corporation, and to organize the exhibits made by them at the World's Columbian Exposition in Chicago. These exhibits were of unusual interest, including the original locomotive, 'John Bull,' and many other historic objects, and of them he prepared a catalogue, which formed a volume of almost two hundred pages, which was published by the Pennsylvania Railroad in 1893.

At the close of the World's Fair in Chicago, the Field Columbian Museum was organized, and it was at once apparent that the proper man for the directorship of the Department of Industrial Arts was Dr. Watkins, and he was immediately called to that place, where he remained for one year

organizing the department. The ties that bound him to the National Museum were too strong to be completely severed, and accordingly in 1895 he returned to Washington, resuming his office as Curator of Mechanical Technology, which place he continued to hold until his death, as well as that of Superintendent of Buildings, which his early training as an engineer made him most competent to fill.

The information that he acquired naturally led to the publication of numerous papers, and among these may be mentioned 'Beginnings of Engineering' (1888); 'The Development of the American Rail and Track' (1889); 'The Log of the Savannah' (1890); and 'Transportation and Lifting of Heavy Bodies by the Ancients' (1898). It culminated in his being chosen to prepare the history of the Pennsylvania Railroad, 1845–1896, a series of quarto volumes descriptive of the first fifty years of that railroad, which is beyond doubt the most complete history of the beginnings of railroad transportation in the United States.

As his reputation increased, he became more and more widely known as the great American authority on the history of mechanical arts, and in recognition of his work in this direction, the Stevens Institute of Technology conferred upon him the degree of Doctor of Science. He served as a juror on his specialty at the expositions held in Atlanta, Omaha and Buffalo.

Dr. Watkins was exceedingly loyal to the city of Washington. He was the moving spirit in the Patent Centennial that was held in Washington in 1891, acting as secretary of the executive committee, and had much to do with the volume that was subsequently published. He also served on various committees in connection with the inaugurations of the presidents and of the centennial celebration of the capitol. He was a member of the Cosmos Club, the American Society of Civil Engineers, the Society of Colonial Wars, the Society of Sons of the Revolution, the Society of the War of 1812, of which he was for some time treasurer, and the Washington Philosophical Society, of which he was for many years secretary.

Following the custom that has prevailed on similar occasions a meeting of the officers and employees of the Smithsonian Institution was held on August 12, for the purpose of taking action on the death of Dr. Watkins, and the following minute prepared by a committee consisting of Dr. Cyrus Adler, Mr. W. de C. Ravenel and Professor W. H. Holmes was adopted:

> In the death of J. Elfreth Watkins, the Smithsonian Institute is deprived of the services of a loyal, able and intelligent official; the foremost authority on the history of transportation and of the mechanical arts in America; and a man whose reputation extended far beyond the confines of his own country. He pursued his scientific and administrative labors under physical infirmities which would have crushed the ordinary man, yet he had the heart and found the time to be kind and helpful to every one with whom he came in contact, from the humblest to the highest. He was the founder of the collection of transportation and of the history of invention now in the National Museum, and from his pen there were contributed many notable memoirs on these subjects. He was upright, hospitable, generous, and leaves behind him the memory of a conscientious official, an upright man, a patriotic American, a notable contributor to scientific literature and a sense of personal bereavement on the part of all who have ever had the good fortune to be associated with him. His colleagues and friends extend to his widow and his children their deepest sympathy in this great bereavement, with the expression of consolation which the contemplation of the life and deeds of such a man must afford to those who loved him.

MARCUS BENJAMIN.

SOCIETIES AND ACADEMIES.

THE TEXAS ACADEMY OF SCIENCE.

AT the regular meeting of the Texas Academy of Science held in the Biological Lecture Room of the University of Texas, April 17, 1903, Mr. Robert A. Thompson, president of

the academy and expert engineer to the State Railroad Commission, delivered an illustrated lecture upon 'Mechanical Interlocking Devices at Railroad Crossings.' Fifty views taken in various parts of the United States were used to show the value of these mechanisms in the matter of safety to trains and in the gain of time—factors of the greatest importance in modern railroading. Dr. Eugene P. Schoch, instructor in chemistry in the university, explained from a recent point of view 'The Effect of Carbon upon Steel.'

The second formal meeting of the year was held in the Chemical Lecture Room of the university on June 10, 1903, at 3:30 P.M. The program on this occasion was as follows:

Dr. Harry Yandell Benedict, Associate Professor of Mathematics in the University of Texas: 'An Ideal History of Experiments on the Regular Pentagon.'

Dr. Eugene P. Schoch, Instructor in Chemistry in the University of Texas: 'Two New Lecture Experiments in Physical Chemistry.'

Thomas U. Taylor, Professor of Applied Mathematics in the University of Texas: 'The Northwest Boundary of Texas.'

Augusta Rucker, M.A., Instructor in Zoology in the University of Texas: 'A New Texan Kœnenia' (by title).

Dr. William L. Bray, Associate Professor of Botany in the University of Texas: 'The Vegetation of the Sotol Country' (by title).

A. M. Ferguson, M.S., Instructor in Botany in the University of Texas: "Some Recent Discoveries Concerning the So-called Ant 'Mushroom Gardens'" (by title).

Dr. Frederic W. Simonds, Professor of Geology in the University of Texas: 'Notes on the Topography of Texas' (by title).

The ballots having been counted, the following officers were declared elected for the year 1903–4:

President—Dr. Edmund Montgomery, Hempstead.

Vice-President—Dr. William L. Bray, Austin.

Treasurer—Mr. R. A. Thompson, Austin.

Secretary—Dr. H. Y. Benedict, Austin.

Librarian—Dr. William T. Mather, Austin.

Members of the Council—Hon. Arthur Lefevre, Superintendent of Public Instruction; Dr. H. L. Hilgartner and Dr. S. E. Mezes.

Frederic W. Simonds.

DISCUSSION AND CORRESPONDENCE.

THE INTERNATIONAL CONFERENCE OF ARTS AND SCIENCE.

To the Editor of Science: I have read with much interest the letter of Professor Dewey with respect to Professor Münsterberg's classification of the sciences. Several months ago there fell into my hands the enclosed copy of a 'Preliminary Program for the Official Addresses at the International Congress of Arts and Science' of the forthcoming exposition at St. Louis in 1904. Since this remarkable document is marked '*Confidential*, Proof under Revision,' it has been so treated by me up to the present date.

In the meantime, Professor Münsterberg, in an article on 'The St. Louis Congress of Arts and Sciences,' published in the *Atlantic Monthly* for May, 1903, has acknowledged himself as the author of the classification of the sciences set forth in the 'Program' and has led his readers to infer that this classification has been provisionally if not definitely accepted by the congress. He writes as a member of the 'Committee on Plan and Scope' of the congress and as the special representative of the 'philosophical sciences.' To quote his own words, he 'steps up to the honored platform of Park Street,' wherever that may be, 'and tells a wider circle what those plans are, and why they ask for interest and favor.'

We may perhaps doubt whether Professor Münsterberg speaks for the entire committee referred to, but since his explanation and defense of the 'Program' has been thus before the public for upwards of three months, it seems proper to assume that he invites criticism of his scheme of classification of the sciences from a larger circle of thinkers than that which centers in Park Street. I beg, therefore, to second Professor Dewey's invitation of the attention of the readers of Science to this matter and to submit a few brief remarks thereon.

The criticism which Professor Münsterberg's classification of the sciences seems to require is aimed not so much at the scheme itself as at the extraordinary claims he makes

for it. Any scheme that is workable may do well enough for the mere purposes of an international congress. But he would have us or, at any rate, the literary audience to which he addresses his exposition, believe that he has at last solved one of the great philosophical riddles. "The real interest," he says, "lies in the logic of the arrangement. The logical problem how to bring order into the wilderness of scientific efforts has fascinated philosophers from Aristotle and Bacon to Comte and Spencer. The way in which a time groups its efforts toward truth becomes, therefore, also a most significant expression of the deeper energies of its civilization, and not the least claim which our coming congress will make is that the program of its work stands out as a realization of principles which characterize the deepest strivings and the inmost energies of our own time as over against the popular classifications of the nineteenth century." Thus does the new scheme triumph over all difficulties!

If this were true, or even in part true, the scheme would be very important to men of science. Unfortunately, however, a glance at the divisions and subdivisions of the scheme seems to reveal only another of the numerous systems of *à priori* philosophy carried to the extremes which border on absurdity.

It is needless to discuss in detail a scheme at once so pretentious and so vulnerable. One should see a copy of the 'Program,' or read the exposition of it in the *Atlantic Monthly*. I will only add, Mr. Editor, that while we may not go out of our way to oppose philosophers and literary folks who indulge in such extravagances, it is our duty to repudiate them when they appear in the public press in the guise of science; for they tend only to make science and scientific men ridiculous.

R. S. WOODWARD.

ANTARCTICA.

TO THE EDITOR OF SCIENCE: If Dr. Mill will look anew through 'Antarctica,' he will be unable to find one line criticizing him. I spoke of him necessarily in my letter (SCIENCE, July 10), because he happened to review the monograph. I can assure him I am most pleased with his review and his letter (SCIENCE, August 7) for they help in forcing the facts about antarctic exploration to the notice of scientists. Gradually the truth will be recognized.

That some English geographers persist in ignoring American antarctic explorers is once more demonstrated in the July *Geographical Journal*. In the sketch map of the National Antarctic Expedition, on which the ink is hardly dry, the name of Wilkes Land is omitted as usual. Clarie Land appears once more, regardless of the fact that there is no Clarie Land. D'Urville called some ice cliffs Côte Clarie but he did not see the land behind them, which was discovered, however, a few days later by Wilkes, and which he named Cape Carr. The name of Graham Land is applied again to the land massif which was known as Palmer's Land for about ten years before Biscoe's voyage. I suggested that the name West Antarctica be given to that region, partly in the hope of reconciling international prejudices.

The final suggestion of Dr. Mill deserves unqualified approval. Would it not be possible to send an American expedition, either private or governmental, to reexplore the coast of Wilkes Land? A steamship like the *Bear*, commanded by naval officers, should be able, in the course of one southern summer, to bring back fresh data about the land discovered by Americans in East Antarctica.

EDWIN SWIFT BALCH.

YORK HARBOR,
August 10, 1903.

SHORTER ARTICLES.

KUNZITE, A NEW GEM.

DURING an extended investigation on certain optical properties of the Tiffany-Morgan Gem and Bement Mineral Collections in the American Museum of Natural History it has been my privilege to examine the new lilac-colored transparent spodumene described by Dr. Geo. F. Kunz in SCIENCE, August 28.

Mineral spodumene is usually obtained in large opaque whitish crystals, but from time to time small specimens, often richly colored

and transparent, are found. The three characteristic varieties of the latter are a clear yellow gem spodumene of Brazil,* the green hiddenite or 'little emerald' of North Carolina,† and the lilac sometimes found in Connecticut.‡ These are without doubt remnants of large specimens, which must have been elegant. Spodumene is very subject to alteration and has usually lost all its transparency and beauty of tint.

Kunz (*loc. cit.*) described some large and magnificent crystals of unaltered spodumene, of rich lilac color, which have recently been discovered near Pala, San Diego County, California, in connection with certain other lithia minerals. It has been my good fortune to see and handle from this locality massive spodumene crystals ($10 \times 20 \times 4$ cms.) perfectly clear, of a rose lilac tint, varying with the spodumene dichroism, from a very pale tinge when observed transversely to the prism, to a rich amethystine hue longitudinally. No such crystals of spodumene have ever been seen before and the discovery is of great mineralogical interest. The crystals have been etched by weathering and have a twinning like the hiddenite variety. The mineral, when cut and mounted parallel to the base, gives gems of great beauty. The chemical analysis, which is under way in my laboratory, will shortly be published.

The observations of Dr. Kunz sufficiently characterize this mineral of peculiar beauty as a new gem, which he has not named. I have submitted large crystals to the action of ultra-violet light without any evidence of fluorescence or phosphorescence. When subjected to bombardment of the Röntgen rays of high penetration for several minutes no fluorescence is observed, but on removal to a dark chamber it exhibits a persistent white luminosity not observed with this class of minerals, as learned by experiments with altered and unaltered spodumene from the localities mentioned, including cut stones and such handsome crystals of hiddenite as afforded by the collections mentioned. I have been able to excite a crystal ($2 \times 4 \times 10$ cms.) by the action of the X-rays for five minutes sufficiently to cause it to photograph itself when subsequently placed directly upon a sensitive plate (thin white paper being interposed) and allowed to remain in an especially constructed padded black box in a dark room for a period of ten minutes. The material is penetrated by the rays as shown by a cathodograph. The excitation is not superficial, but persists throughout the mass. On account of this unusual and characteristic phosphorescence, as well as the other properties, I propose the name *Kunzite,* for reasons unnecessary to give to American and European scientific men. The mineral material and cut gems may be seen at Tiffany and Co.'s or the American Museum of Natural History, New York.

Charles Baskerville.

August 12, 1903.

* Pisani, *Comptes Rendus*, 84, 1509, 1877.

† J. L. Smith, *Am. J. Sci.*, 21, 128, 1881.

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THE TOXIC EFFECT OF H AND OH IONS ON SEEDLINGS OF INDIAN CORN.

Within the last five years or so some attempt has been made to determine the toxic effect of various chemical solutions upon plant life. This involved the theory of ionization, which is based upon the electrical conductivity of solutions.

When acids, bases or salts are put into solution, they separate, more or less completely, into molecules or part molecules of their elements, or into groups of two or more atoms of different elements which are very strongly united. Molecules which exist in this state are known as ions—*e. g.*, if 100 molecules of HCl were put into solution they would separate to form H ions and Cl ions, and probably there would be some HCl ions left, depending upon the strength of the solution. If NaOH were put into solution a like separation would take place except that OH ions and Na ions would be formed in place of the H ions and Cl ions.

All compounds do not permit total dissociation at the same dilution. "Solutions of hydrochloric, nitric and sulfuric acids are nearly completely dissociated when an equivalent in grams is dissolved in 1,000 liters of

water." * "Solutions of hydrochloric, nitric and sulfuric acids are practically completely dissociated when an amount of these compounds in grams equal to their molecular weights divided by the number of H atoms (one gram equivalent) is added to one liter of distilled water."†

These statements are contradictory. Though the former states HCl is nearly completely dissociated at $n/1000$ and the latter states that the same acid is practically completely dissociated at a normal solution, yet both are incorrect; but to be exact it is also practically completely dissociated at a concentration four times $n/1000$ dilution, $n/250 = 98.9$.‡

Other weaker compounds may have some undissociated ions—*e. g.*, NaCl at a certain dilution is 80 per cent. dissociated; that is, if there were 100 molecules of NaCl and 80 per cent. of them were dissociated there would be 80 Cl ions and 80 Na ions and 20 NaCl ions.

The degree of dissociation increases as the dilution increases until a dilution is reached when the dissociation is practically complete.

Since the degrees of dissociation in compounds capable of dissociation vary with the dilution, it is necessary to find the degree of dissociation before it is possible to determine the exact toxic effect of each kind of ions in the various solutions—*e. g.*, if a seedling just lives in a solution of KOH 1/128 gram equivalent dissolved in distilled water and made up to 1,000 c.c., and dies in a NaOH solution of the same dilution, one of two things must be true,—either the degree of dissociation in KOH is less than the degree of dissociation in NaOH at the above-named dilution or the Na ions have an appreciable toxic effect at this dilution, but it has been stated by MacDougal§ that at such weak dilutions sodium salts have no appreciable influence, hence the difference in the toxic effect of the two solutions must be due to the difference of dissociation.

It has been stated that it is the H ions and those containing H which are fatal.*

It is the object of the following experiment to find in what dilution KOH, NaOH, HCl and H_2SO_4 seedlings of Indian corn (*Zea Mais*) will be killed, and deduce facts concerning the toxic influence of H and OH ions upon these seedlings.

In order to be clearly understood in regard to terms used it might be well to give some quotations regarding them.

Gram-Molecule (Arrhenius, p. 9).—"Thus, for example, the molecular weight of HCl is 36.46, and consequently 1 gram-molecule of this (HCl) is 36.46 grams, that is, the equivalent weight in grams; a gram-molecule of sulfuric acid is 98 grams, *i. e.*, twice the gram equivalent."

Gram-equivalent (Arrhenius, p. 9).—"By a gram-equivalent of zinc we mean 32.7 grams of this metal; a gram-equivalent of a substance whose equivalent weight is E is E grams." Thus we see that a gram-equivalent of a monobasic substance is equal to its molecular weight, and of a dibasic substance is equal to one half its molecular weight.

Normal Solution (Sutton, p. 28).—"Normal solutions are prepared so that one liter of solution at 16° C. shall contain the hydrogen equivalent of the active reagent in grams (H = 1)." Fresenius (p. 687): "Solutions of such strength that 1,000 c.c. contains an amount of acid or base equivalent to one gram of hydrogen are normal solutions, *e. g.*

	Mol. wt.	Wt. in 1,000 c.c. of solution.
HCl	36.46	36.46
H_2SO_4	98.00	49.00
Na_2Co_3	106.08	53.04

The normal solutions used in this experiment were made according to the definitions of normal solutions by Sutton and Fresenius.

Tests in this experiment were made with each of four different dilutions of four different solutions, two of alkali, KOH and

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* *L. c.*, p. 53, par. 78.

NaOH, and two of acid, HCl and H_2SO_4. The alkali solutions were *n*/32, *n*/64, *n*/128 and *n*/256. The acid solutions were *n*/256, *n*/512, *n*/1,024 and *n*/2,048.

The corn, which was chosen on account of its rapid growth and its straight main root, was soaked twenty-four hours, then put into a germinator containing sphagnum and allowed to remain forty-eight hours until the main roots were about 15 cm. long.

The tests were made in test glasses with a capacity of about 60 c.c. These glasses were thoroughly cleaned before using. Before the tests were made with the alkali the glasses were first washed with normal HCl, then with normal solution of the alkali used in the test, then they were washed and rinsed with water, then rinsed with distilled water, then with some of the solution used in the test. Before the tests were made with the acids the glasses were cleaned by the same process except that they were washed first with alkali solution then with acid solution.

The glasses were filled two thirds full of the solution to be used and labeled, then the seedling was taken from the germinator, carefully removing all the sphagnum; the grain was wrapped in dry cotton wool and fitted firmly in the top of the test glass, but not touching the solution, but the main root reached into the solution at least 10 cm. On the outside of the glass exactly opposite the tip of the root a dot was made with india ink, always holding the tip of the root in a line horizontal to the eye and sighting through the middle of the glass while marking.

The glass and seedling were then put into a dark chamber at a temperature of from 20° to 30° C. for twenty-four hours, after which the growth or elongation was measured. Then the seedling was removed, lightly washed with distilled water and put into a thoroughly cleaned glass with distilled water and allowed to remain in the dark chamber for another twenty-four hours, after which it was again measured.

The tests were started at 10 A.M. The four dilutions of one solution were carried on at the same time.

The results of the experiments were as follows:

Table I. Solutions of KOH. Begun May 21, 10 A.M., Closed May 23, 10 A.M.

Concentration.	Growth in m/m.	Remarks.	Distilled.	Growth in m/m.	Remarks.
n/32	0	Flabby, dead.	H_2O	0	Flabby, dead.
n/32	0	Flabby, dead.	H_2O	0	Flabby, dead.
n/64	3	Yellowish. Probably only elongated.	H_2O	0	Root tip coagulated, dead.
n/64	1	Probably only elongated.	H_2O	0	Root tip coagulated, dead.
n/128	10	Natural appearance.	H_2O	15	Natural, alive.
n/128	7	Natural appearance.	H_2O	10	Natural, alive.
n/256	16	Natural appearance.	H_2O	19	Natural, alive.
n/256	17	Natural appearance.	H_2O	18	Natural, alive.
	54	Total growth.		62	Total growth.

We see by reference to the above table that there was a decided growth at *n*/256 and *n*/128 solutions, and when the seedlings were put into distilled water the growth was approximately the same. Thus it is evident that the elongation of the roots was due to actual growth.

In the tests with NaOH the results were similar to those of KOH, from which we might conclude that the toxic action of the two solutions is similar. However, the roots in NaOH *n*/64 had an appearance more nearly natural after each twenty-four hours than the roots in KOH of the same dilution; which suggests that the Na and K ions at this dilution might have some toxic influence and that of the K ions is greater than that of the Na ions.

TABLE II. SOLUTIONS OF NaOH. BEGUN MAY 26, 10 A.M., CLOSED MAY 28, 10 A.M.

Concentration.	Growth in m/m.	Remarks.	Distilled.	Growth in m/m.	Remarks.
n/32	0	Flabby.	H_2O	0	Flabby, dead.
n/32	0	Flabby.	H_2O	0	Flabby, dead.
n/64	1	Probably only elongated. Yellowish.	H_2O	0	Root appears natural except at the tip, dead, (?).
n/64	3	Yellowish.	H_2O	0	Root appears natural except at the tip, dead, (?).
n/128	12	Growth in a circle. Natural appearance.	H_2O	20	Natural, alive.
n/128	20	Natural appearance.	H_2O	30	Natural, alive.
n/256	11	Natural appearance.	H_2O	35	Natural, alive.
n/256	13	Natural appearance.	H_2O	20	Natural, alive.
	60	Total growth.		105	Total growth.

TABLE III. SOLUTIONS OF HCl. BEGUN JUNE 1, 10 A.M., CLOSED JUNE 3, 10 A.M.

Concentration.	Growth in m/m.	Remarks.	Distilled.	Growth in m/m.	Remarks.
n/256	2	Probably only elongated. Roots have pallid appearance.	H_2O	0	Coagulated, dead.
n/256	1	Roots have pallid appearance.	H_2O	0	Coagulated, dead.
n/512	18	Natural appearance.	H_2O	6	Natural, alive.
n/512	15	Natural appearance.	H_2O	21	Natural, alive.
n/1024	20	Natural appearance.	H_2O	36	Natural, alive.
n/1024	35	Natural appearance.	H_2O	30	Natural, alive.
n/2048	25	The root grew in a curve of 180°.	H_2O	20	Completed a circle.
n/2048	28	The root grew in a curve of more than 180°.	H_2O	25	Completed the circle then grew straight up.
	146	Total growth.		138	Total growth.

TABLE IV. SOLUTIONS OF H_2SO_4. BEGUN JUNE 4, 10 A.M., CLOSED JUNE 6, 10 A.M.

Concentration.	Growth in mm.	Remarks.	Distilled.	Growth in mm.	Remarks.
n/256	3	Natural appearance.	H_2O	0	Dead (?).
n/256	3	Natural appearance.	H_2O	0	Dead (?).
n/512	48	Natural appearance.	H_2O	40	Natural, alive.
n/512	35	Natural appearance.	H_2O	16	Natural, alive.
n/1,024	60	Natural appearance.	H_2O		Accident.
n/1,024	60	Natural appearance.	H_2O	50	Natural, alive.
n/2,048	50	Natural appearance.	H_2O	30	Natural, alive.
n/2,048	38	Natural appearance.	H_2O	16	Natural, alive.
	297	Total growth.		152	Total growth.

By comparing the total growth in H_2SO_4 with the total growth in HCl we see that the amount of growth in H_2SO_4 was over twice the total growth in HCl, but the difference in the total growth in H_2O after the seedlings were taken from the acid solutions was but small (20 mm.). This suggests that the ions in the HCl solutions produce a greater toxic effect upon the seedlings than those of H_2SO_4.

By comparison of the above tables we see that at the dilutions of the compounds used, the toxic effects of KOH and NaOH are practically the same, and the toxic effects of HCl and H_2SO are *approximately* the same.

In regard to the degree of dissociation of strong bases Arrhenius says:* "In the saponi-

* Arrhenius, 'Text-Book of Electro-Chemistry,' p. 184.

fication of bases it has been found that all strong bases exert about the same action. The velocity of reaction at 9°.4 is:

NaOH	2.31	$Sr(OH)_2$	2.20
KOH	2.30	$Ba(OH)_2$	2.14
$Ca(OH)_2$	2.29		

The numbers are for 1/40 normal solutions, in which the strong bases may be regarded as completely dissociated." As the dilution of the alkali at which death was produced was much greater the dissociation must have been complete, hence the death must have been caused by the OH and Na or K ions. And as the total growth of the seedlings in KOH solutions is nearly equal to the total growth in NaOH solutions, we can conclude that the toxic effect of Na ions is approximately equal to the toxic effect of K ions.

From a table of electrical conductivity* the degree of dissociation of HCl at $n/256$ was found to be 98.9, at $n/512$ it was found to be 99.5. The degree of dissociation of H_2SO_4 at $n/256$ was found to be 91, at $n/512$ it was found to be 95.6.

By comparing the dilutions at which the seedlings were found dead with the degree of dissociation given above it will be seen that there is quite a difference between the degrees of dissociation at the strength of the two solutions (HCl and H_2SO_4). While at the greatest dilution in which the seedlings lived in both solutions the difference is not so great. This difference in the degree of dissociation was manifest in the difference in the total growth of the seedlings in the different solutions; the solution less dissociated producing the greater total growth.

Thus we see that the corn seedling lived and grew in a $n/128$ solution of KOH and NaOH, and in $n/512$ solution of HCl and H_2SO_4. While Kahlenberg and True showed that a seedling of *Lupinus albus* L. just lived in $n/400$ solution of KOH and in $n/6{,}400$ solution of HCl. This shows that corn seedlings lived in a solution of KOH more than three times as strong, and in a solution of HCl more than twelve times as strong, as that in which the seedling of *Lupinus albus* just lived.

Although a seedling of a widely different species was used by Kahlenberg and True, yet it is remarkable that the corn seedling should resist the toxic effect of OH ions in a solution three times as concentrated, and that it should resist H ions in another solution twelve times as concentrated.

If the difference between the effects of the OH ions in one case is three times, why should we not expect the difference between the effects of the H ions in the other case to be about three times also? It seems logical to expect that the ratio between the effects of like solutions upon two different seedlings would be about the same in any solution.

It is my purpose to continue the investigation of this problem to find the exact dilution in which the seedling will just live; and how this death limit varies with different seedlings.

Fred A. Loew.

Agricultural College, Mich.,
June 16, 1903.

* Arrhenius, *l. c.*, p. 135.

THE SPONGY TISSUE OF STRASBURGER.

Many students of the gymnosperms have commented upon the peculiar structure of the cells immediately surrounding the female gametophyte during the period of its development. Both Hofmeister* and Strasburger† believed that two prothallia were formed in those members of the Abieteæ which require two years for the maturation of their seeds. They thought that the first or transitory prothallium was characterized by thickened cell-walls and that this cellular body was dissolved in the spring, giving place to the true or normal prothallium.

In 1879 Strasburger‡ established the fact of the existence of a single prothallium in the Abieteæ, and described a band of loosened

* Hofmeister, 'Vergleichende Untersuchungen höherer Kryptogamen und der Samenbildung der Coniferen,' 1851.

† Strasburger, 'Die Befruchtung bei den Coniferen,' 1869. 'Ueber Befruchtung und Zelltheilung,' 1878.

‡ Strasburger, 'Die Angiospermen und die Gymnospermen,' 1879.

cells or spongy tissue about the young gametophyte both in *Thuja* and in *Pinus*. He considered that it was the presence of this tissue which led Hofmeister to conclude that a transitory endosperm was formed in these plants. So far as one is able to learn from the literature, these early observations and conclusions of Strasburger's have remained unquestioned except by a few recent writers.

In describing the development of the ovule in Stangeria, Lang* (June, 1900) makes no mention of a spongy tissue, but says: "Around the megaspore a layer of cells was present which is clearly to be traced to the sporogenous group. The thick zone of sporogenous tissue present in earlier stages has, however, become reduced to a single layer. The cells of this persistent layer (Fig. 16) are very large, and stand with the longer axis at right angles to the surface of the megaspore. How long this layer of cells, which at this stage shows no signs of crushing or disintegration, persists, can not at present be determined; in the fertilized seeds all trace of it was gone. In the light of the present facts it would appear to be a probable conclusion that, while the majority of the sporogenous cells surrounding the embryo-sac simply become disintegrated and absorbed, the outermost form a more definite tapetal layer. This tapetum, while persisting longer than the more internal cells, ultimately disappears." The figure 16 to which Lang refers shows the persistence of this layer after the prothallium has become a multicellular body.

The manuscript of a paper by the writer† dealing with the development of the pollen tube in the pines had been in the hands of the publishers some weeks before Lang's paper appeared in America. It was not my purpose to give a detailed description of the development of the prothallium and related phenomena in that paper, inasmuch as this was to form the basis of a later paper now ready for publication; but incidentally the following statement was made: "The prothallium now consists of a uniform layer of protoplasm in which numerous free nuclei are embedded, no cell-walls as yet having been laid down. Immediately surrounding the endosperm, there is a definite band or hollow sphere of cells which is limited on its outer surface by a thin stratum of the disintegrating nucellus. These two layers constitute the so-called spongy tissue. The inner portion of this tissue, *i. e.*, the prominent band in immediate contact with the prothallium, must be intimately connected with the nutrition of the young endosperm. The true structure and function of this layer seem to have escaped the notice of previous writers. Its cells contain large nuclei, and are abundantly supplied with protoplasm. The karyokinetic figures so frequently observed in these cells show that this tissue increases in size by the growth and division of its cells as do the other portions of the ovule. As it enlarges, the cells of the nucellus in contact with its outer surface become disorganized and are absorbed (Fig. 3)." The figure referred to shows the prothallium and the disintegrating nucellar tissue separated by a definite zone of tissue two layers of cells in thickness. The cells of this band are conspicuous for their size and three of them show mitotic figures representing different stages of division. In Fig. 4 of the same paper this tissue is shown to be still present, but in a state of disorganization, at the time when the prothallium has become a solid multicellular body, and shortly before the division of the central cell.

Coker* finds that in *Podocarpus* "the macrospore arises deep in the nucellus and is not surrounded by spongy tissue such as is found in the Abieteæ, Cupresseæ, and Taxodieæ, and which has so often been erroneously described as of sporogenous character." To this statement he adds the remark: "Miss Ferguson's suggestion that the spongy tissue

* Lang, 'Studies in the Development and Morphology of Cycadean Sporangia.' II., 'The Ovule of *Stangeria paradoxa*.' *Ann. Bot.*, **14**: 281–306. 1900.

† Ferguson, 'The Development of the Pollen-Tube and the Division of the Generative Nucleus in Certain Species of Pines.' *Ann. Bot.*, **15**: 193–223. 1901.

* Coker, 'Notes on the Gametophytes and Embryo of *Podocarpus*.' *Bot. Gaz.*, **33**: 89–107. 1902.

is active in nourishing the prothallium is probably correct; an interpretation I had arrived at from a study of *Taxodium*."

I discussed somewhat in detail the structure and function of this tissue in a paper given before the Society for Plant Morphology and Physiology at its Washington meeting in 1903. In a brief summary of the paper* this sentence occurs: "The spongy tissue is not disintegrating tissue, as previously stated, but it forms a zone of physiological tissue which plays an important part in the nutrition and support of the developing gametophyte."

In a paper appearing in the current number of the *Botanical Gazette* (July, 1903), Coker† devotes three pages to a discussion of this tissue in *Taxodium*, designating it 'The large-celled tissue or tapetum.' His very clear description is accompanied by several figures representing this tissue at different periods in the development of the gametophyte. He finds that a definite band of large-celled tissue is early organized about the macrospore separating it from the disorganizing nucellar tissue. This large-celled layer continues until the prothallium has nearly or quite reached maturity. He ascribes to this tissue 'an active part in the nourishment of the young gametophyte,' and believes that it 'may be considered as a tapetum.' But he makes no reference at all to the application by Lang of the term tapetum to a similar tissue in *Stangeria;* neither does he in any way indicate that the active nature of this tissue has been noted by any other investigator. Furthermore, one can but be surprised to find such unqualified statements as: 'Moreover, this tissue in the Abieteæ is always spoken of as disorganizing'; and, 'I do not know of any case, however, where this tissue is said to persist in later stages.'

The tissue in contact with the outer surface of the gametophyte during its period of growth in *Taxodium*, as described and figured by Coker, is very similar to that occurring in *Pinus*. The various stages in the life history of the spongy tissue in *Pinus* are fully described and illustrated in a paper now in the process of publication, and I will not, therefore, repeat the details of its development here.

The presence of an active tissue about the growing prothallium in many gymnosperms is now an established fact, but our knowledge of the true nature of this tissue remains for the present more or less obscure. Lang (1900) speaks of it as both sporogenous and tapetal in nature. Coker (1903) suggests that it may 'represent an originally archesporial tissue which has given up its function of spore production and taken up the new rôle of nourishing the young plant within,' but he prefers to consider it a tapetum. It is not impossible that these cells are sporogenous in nature, each being a potential macrospore-mother-cell, but in a careful study of their origin and development I find no evidence that such is the case. If they represent the sporogenous tissue of some remote ancestor, they have beyond any question now lost their primitive function and have acquired a new and important function in connection with the development of the gametophyte. It is probable that this tissue not only passes on to the endosperm the nutritive substance derived from the nucellus, but that it is itself active in the manufacture of food, as Coker reports the presence of numerous starch grains within its cells in *Taxodium* and I have often observed them in *Pinus*. Furthermore, I believe that, in addition to its physiological rôle, this tissue serves an important mechanical purpose. It not only affords support for the prothallium during the long period in which it consists of a thin layer of cytoplasm containing free nuclei, but, gradually receding, it pushes before it, as it were, the tissue of the nucellus, thus making room for the growth of the delicate gametophyte.

There is certainly a very strong analogy between this tissue and a tapetum, but we are entirely in want of any evidence that the two are homologous structures. It does not, therefore, seem to me wise at present to apply to it the name tapetum, or to suggest a

* Ferguson, 'The Development of the Prothallium in *Pinus*.' *Science*, N. S., **17**: 458. March, 1903.

† Coker, 'On the Gametophytes and Embryo of *Taxodium*.' *Bot. Gaz.*, **34**. July, 1903.

new name by which to designate it. Strasburger's term 'spongy' tissue, although given when the nature of these cells was not understood, and being a misnomer so far as their structure and function are concerned, has obtained a wide usage in the literature of the gymnosperms and should be retained, just as the term cell is still retained in all biological literature.

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RECENT LITERATURE ON TRIASSIC ICHTHYOSAURIA.

WITHIN the past few months two important contributions have been made to our knowledge of the Triassic Ichthyosauria of the Eastern Hemisphere. The more extensive of these papers is one by Dr. E. Repossi,* giving the long-desired exact description and illustration of the material upon which Baur based the genus *Mixosaurus*. In this paper the statements of Baur concerning the primitive characters of this genus are strongly supported and many previously unknown and even unsuspected characters have been brought to light.

One of the most important contributions made by Repossi is the description of the pectoral and pelvic arches. These are quite unlike those of any Post-Triassic form of the order, but show a strong similarity to the corresponding structures in the Californian genus *Shastasaurus*. All of the elements excepting the ilium and clavicle are much broader and more robust than in *Ichthyosaurus*. The inter-clavicle is more nearly triangular than T-shaped nd is hence more stegocephalian. The scapula, like that of *Shastasaurus*, has more of a mosasaurian than of an ichthyosaurian aspect.

Beautifully preserved specimens show the limbs to be pentadactyle with elongated epipodial bones and notched or sometimes shafted phalanges. A peculiar feature is found in the presence of four elements in the proximal row of the carpus and tarsus. Were it not for the character of the specialized mesopodial region, these limbs might well be considered as the primitive types from which the limbs of *Ichthyosaurus* were derived. The limb structure differs considerably from the types found in the Californian genera, both in the number of digits and in the character of the mesopodial region.

Another interesting discovery is the fact that the dorsal ribs of *Mixosaurus* are mainly single-headed. Those who have concerned themselves with this group seem generally to have taken for granted a double rib articulation.

A second paper of interest dealing with Triassic Ichthyosauria is one by N. Yakowlew on 'New Finds of Triassic Saurians in Spitzbergen.'* One of the specimens here described was found near the locality at which the type of Hulke's *Ichthyosaurus polaris* was discovered by Nordinskiöld, and as it resembles *I. polaris* in the size and general form of the vertebræ, it has been referred to this species. A posterior dorsal vertebra which has been figured is shown to differ from *Ichthyosaurus* in possessing a single broad apophysis for the articulation of the rib. This species is, therefore, placed by Yakowlew in the genus *Shastasaurus*. The vertebra is certainly very similar to some of the posterior dorsals of *Shastasaurus*. After a study of Hulke's descriptions and measurements of the type material, the writer has already expressed the opinion† that a careful examination would show it to belong in the Californian genus.

In this paper the valuable suggestion is made by Yakowlew that the ribs of the Ichthyosauria were primitively single-headed and that the double-headed form has been produced by more complicated and stronger movements of the ribs, causing disappearance of the middle portions of the rib heads and of the corresponding parts of the lateral apophyses

* 'Em. Repossi. Il Mixosauro degli strati triasici di Besano in Lombardia,' *Atti della soc. ital. di scien. natur.*, Vol. XLI., Fasc. 3, p. 361–372 tav. VIII., IX. Novemb., 1902.

* 'Neue Funde von Trias-Sauriern auf Spitzbergen,' *Verhand. der Kais. Russ. Mineralog. Ges.*, Bd. XL., S. 179–202.

† 'Triassic Ichthyopterygia of California and Nevada,' p. 88.

of the vertebræ. In a later article* written mainly in review of Repossi's paper on *Mixosaurus,* Yakowlew expresses the opinion that the double-headed character appeared first in the posterior portion of the dorsal region owing to the more vigorous movement of that portion of the body. It is difficult to reconcile this theory with the fact that in *Ichthyosaurus* the ribs tend to be single-headed toward the base of the tail and double-headed anterior to it, and that in *Shastasaurus,* which had also a great sculling tail, the ribs are all single-headed excepting a very few immediately behing the head.

Concerning Yakowlew's suggestion that the single-headed rib is the primitive type in this order, it is certainly a significant fact that it seems to occur frequently in the Triassic ichthyosaurs. We should not forget, however, that the oldest representative of the order which has been described, viz., Quenstedt's *atavus,* from the lower Muschelkalk, is said to have a double articulation and is possibly not to be referred to *Mixosaurus,* as has been generally supposed. Recent discoveries have shown the existence also in the Californian Triassic fauna of a form (*Toretocnemus*†), in which the middle dorsal ribs are as widely forked as in *Ichthyosaurus.* Again, it appears that in *Shastasaurus* the double articulation in the anterior part of the column is not formed by reduction of the middle portions of simple lateral apophyses. From the atlas to the anterior dorsal region the diapophyses are gradually increased in height and the parapophyses reduced till the latter are mere points some distance below the lower ends of the diapophyses. The lateral apophyses of the dorsal region, therefore, correspond to the diapophyses in the cervical region. If the double articulation in the neck region is secondary it would appear to have required the *addition* of a lower rib head and a parapophysis. There appears, therefore, to be still a chance that the double articulation is primitive in this group, and it may be well to withhold final judgment till we have a better acquaintance with the structure of the vertebral column as a whole in the later Triassic forms, and particularly till we know more about the Middle Triassic representatives of the group.

JOHN C. MERRIAM.

* 'Einige Bemerkungen ueber die triassischen Ichthyosaurier.' *Verhand. der Kais. Russ. Mineralog. Ges.,* Bd. XL., Lief II.

† See *Bull. Geol. Dept. Univ. of Calif.,* Vol. 3, No. 12, p. 260.

NOTES ON PHYSICS.

INTERFERENCE OF LIGHT WITH GREAT PATH DIFFERENCE.

THE most carefully designed and constructed mechanical vibrator, such as a pendulum, cannot be made to vibrate, when left to itself, more than a few thousands of times without greatly decreasing in amplitude. On the other hand, the number of free oscillations made by an atom of a luminous gas during the intervals between collisions between that atom and others, during which times the atom is presumably not receiving energy from any source to make good its losses by radiation, is, in the case of mercury vapor at least, as many as 2,600,000 and that without very great decrease of amplitude. This follows from some recent work of Lummer and *Gehrcke,* who have recently shown that a given portion of the beam of light from mercury vapor (the green rays) is in condition to interfere with a portion of the same beam 125 centimeters or 2,600,000 wavelengths farther along the beam, which shows that as many as 2,600,000 successive waves come without a break of continuity from the vibrating luminous particles in mercury vapor.

THE ELECTROMAGNETIC THEORY OF MATTER.

The most complete and readable presentation hitherto made of the mathematical theory of the motion of minute electric charges (electrons) is given by Max Abraham in *Drude's Annalen* for January, 1903. It is by comparison of the results of this mathematical theory with results of experiments on cathode and Becquerel rays, on the Zeeman effects, etc., that the electromagnetic theory of matter has arisen.

An electrically charged body in motion has more momentum and stores more energy, in

other words it has apparently a greater inertia mass, than the same body without charge, and the electrical part of the mass is greater and greater the smaller the size of the body. The idea, which is fast gaining strength, that atoms are aggregates of extremely small charged particles, corpuscles as J. J. Thomson calls them, has given credit to the hypothesis that inertia is wholly electrical in character, inasmuch as an atom is known not to be small enough, assuming it to be homogeneous, to permit of its inertia being attributed wholly to its electric charge. The word *electron* seems to be most acceptable as a name for these ultimate corpuscles of disembodied electric charge.

The 'mass' of an electron is not fixed in value but it increases with velocity. In fact the very rapidly moving electrons (95 per cent. of the velocity of light) in Becquerel rays have greater mass than the more slowly moving ions in cathode rays, and measurements of mass and velocity of the electrons in cathrode rays and in Becquerel rays are in accord with the theoretical law of increase of mass with velocity. When an electron is accelerated in the direction of its motion its mass is different (longitudinal mass) from when it is accelerated at right angles to its direction of motion (transversal mass). The difference between longitudinal and transversal mass is sufficiently great numerically, when the velocity is great, to be an essential element in the established correspondence between theory and observation above mentioned.

The inertia or mass of the electron is purely electromagnetic in character; and if atoms and molecules are mere aggregates of electrons it follows that all mass and inertia are electromagnetic in character.

Some very curious laws of motion arise from the electron theory. When velocities and accelerations are very small Newton's laws of motion apply as very close approximations. When velocities or accelerations are large Newton's laws of motion fail utterly. One point of failure is the above-mentioned distinction between longitudinal and transverse mass—mass is not a scalar quantity but a so-called linear vector function; other curious points in the motion of electrons are the following:

Uniform motion in a straight line once established is steady or permanent. Uniform motion of an electron in a circular orbit, on the other hand, is accompanied by continuous radiation of energy, so that such motion must eventually cease if it is not maintained by some external agent. Thus two electrons rotating about each other after the manner of planet and satellite slowly radiate energy, and their motion is affected very much as if they were in a resisting medium. This motion of electrons as satellites is the fundamental hypothesis in the theory of the Zeeman effect.

A continuously accelerated electron stores an increasing amount of kinetic energy which can be regained by stopping the electron, and in addition it radiates energy continuously, which energy is lost. If the acceleration is very great this radiation may be considerable. Therefore, there is a drag upon the electron which is something like viscous friction but which depends upon *acceleration* and not on *velocity*.

An electron under way will, if quickly stopped and released, start up again of itself and move with diminished velocity in the original direction.

When an electron gains a certain velocity under the action of an accelerating force and the force suddenly ceases to act, then the electron loses some of its velocity and settles down to a slightly decreased uniform velocity.

An electron started quickly and kept moving at uniform speed must be acted upon, of course, by a great force to produce the quick start, and also by a lasting force which slowly drops to zero.

The kinetic energy of an electron is not proportional to the square of its velocity. This is another way of stating the fact which lies at the foundation of the variation of mass with velocity, and of the distinction between longitudinal and transverse mass. Thus, the only case in which an added velocity Y in the direction of the y-axis of reference means the same amount of work done whether

the moving particle has or has not already a velocity X in the direction of the x-axis, is the case in which the kinetic energy is simply dependent upon $X^2 + Y^2$.

Not directly connected with this matter of the dynamics of the electron, but of great interest, is the question of the amount of electrical energy stored in the electric field which surrounds an electron. Taking the data which have been obtained from experiments on cathode rays, it appears that a number of electrons sufficient to weigh a gram have associated with them about 6.10^{13} joules (or 40 million million foot-pounds) of energy when stationary. That is, estimating that a hot gas radiates 5 watts per gram, the total electron energy associated with an atom would last for a hundred *million million million* oscillations of full intensity before it were all exhausted by radiation, or rather the energy associated with a pair of rotating electrons would last for a hundred million million million periods before it were all radiated. This gives us some insight into the matter mentioned in the foregoing note on the interference of light with great path difference. It is probable that the limit of path difference which will produce interference is determined by frequency of molecular collisions rather than by diminished amplitude of atomic oscillations between collisions.

Another matter of interest, growing out of the excessively small size of the electron, vastly smaller than the atom, is that the electrons are always at great distances apart in comparison with their size, so that the variations of total energy due to different forms of electron aggregation are but a small fraction of the total energy. Thus the diminution of energy accompanying the formation of a gram of water is only about 16,000 joules or one four-thousand-millionth part of the total electron energy.

Another matter of interest is that the volume integral of ether stress—which may be the fundamental cause of gravitation—is independent of states of electron aggregation to about the same degree of approximation as above pointed out for electron energy.

W. S. F.

CURRENT NOTES ON METEOROLOGY.

MARCH WEATHER PROVERBS.

Mr. B. C. Webber, acting director of the Meteorological Service of Canada, contributes a paper on 'March Winds' to a recent number of the *Monthly Weather Review* (Vol. XXXI., No. 3). On the basis of thirty years' records for Ontario, Quebec and the Maritime Provinces, it appears that there is a considerable decrease in the number of days with high winds in March, as compared with the three preceding months; that the month of March has fewer cold winds than February; that the snowfall of March is very much less than during the preceding winter months, and that there is nothing in the records for the past thirty years to justify the assumption that 'if March comes in like a lion it goes out like a lamb.' Thus do many of the 'popular' sayings about the weather often prove to be without foundation in fact when they are confronted with the results of meteorological observations. The results of the investigation along somewhat similar lines, by W. B. Stockman, of the U. S. Weather Bureau, are discussed in the May *Review*.

HEIGHT OF THE SEA BREEZE.

Observations as to the height of the diurnal sea breeze are few in number, albeit of considerable importance. By means of a captive balloon, sent up from Coney Island a number of years ago, it was found that the average height at which the cool inflow from the ocean was replaced by the upper warm outflow from the land was from 500 to 600 feet. At Toulon, in 1893, the height of the sea breeze was found to be about 1,300 feet, and a distinct off-shore current was found between 1,900 and 2,000 feet. More recently (1902), on the west coast of Scotland, Dines, using kites, has noted that the kites would not rise above 1,500 feet on sunny afternoons, when the on-shore breeze was blowing (*Quart. Journ. Roy. Met. Soc.*, April, 1903).

STORMS OF THE GREAT LAKES.

For some years the Weather Bureau has been giving special attention to the storms which occur over the Great Lakes, with a view

to making navigation on the lakes safer. Bulletin K of the Weather Bureau, by Professor E. B. Garriott, entitled 'Storms of the Great Lakes' (4to, 1903, pp. 9, charts 968), includes 768 charts illustrating the more important storms of the lakes which have been described in the *Monthly Weather Review* during the twenty-five-year period 1876–1900. Each storm is illustrated by four charts, covering thirty-two to forty-eight hours of its history, the object being to present typical lake storms which have occurred in the different months of sufficient intensity to be dangerous to shipping. The month of November, with forty-five severe storms in twenty-five years, stands first. October and December rank in the same group, and then come September and March. The storms are classified as 'southwest storms (the most destructive)'; 'storms from the middle west,' 'northwest storms,' and 'storms of tropical origin.' This *Bulletin* will be useful first of all to the forecasters of the Weather Bureau whose districts embrace part of the Great Lake region, and to navigators on those Lakes, but teachers of meteorology in schools and colleges will find in this very large number of selected charts abundant material for illustration in connection with the study of weather maps and of cyclones.

NOTES.

The Annuaire météorologique pour 1903, of the Royal Observatory of Belgium, contains, in addition to the usual meteorological data and tables, the following special contributions: A. Lancaster, 'La Force du Vent en Belgique' (pp. 220–352); E. Vanderlinden, 'Étude sur la Marche des Cirrus dans les Cyclones et les Anticyclones d'après les Observations faites à Uccle'; J. Vincent, 'Aperçu de l'Histoire de la Météorologie en Belgique, III. Partie.'

Beginning with May 6 last, the meteorological records obtained by means of kites at Hamburg have, together with those obtained at the Berlin Aeronautical Observatory, been published in the daily weather reports of the German Seewarte.

R. DEC. WARD.

BOTANICAL NOTES.

RECENT BOTANICAL PAPERS.

AMONG the recent botanical papers may be mentioned the following:

'The Wood Lot,' by Professor H. S. Graves, of the Yale Forest School, and R. T. Fisher, of the United States Bureau of Forestry. It is published by the United States Bureau of Forestry, and discusses the woodland problems, especially in New England, and makes suggestions in regard to the use and perpetuation of the small bodies of woodland which still persist in that portion of the country. It should prove very valuable to the New England farmer.

'The Seasoning of Timber,' is an interesting paper by Doctor von Schrenk, of the United States Bureau of Forestry. In it he discusses the problems which face the practical man in the seasoning of timber. The distribution of water in the timber, its relation to decay, what seasoning is, something as to preservative treatments, etc., make up the first part of the book, and this is followed by a discussion of experiments made in the west in the endeavor to secure greater durability by treatment of one kind and another. The paper is certainly one of the most helpful of any published by the bureau.

MR. J. N. ROSE, of the United States National Museum, publishes in the Contributions from the United States National Museum, a continuation of his 'Studies of Mexican and Central American Plants.' This contribution covers nearly sixty pages, and is filled with descriptions of new and little-known plants from this very interesting region. Several good colored illustrations accompany the paper.

In a recent number of *Rhodora,* Professor C. S. Sargent continues his descriptions of 'Recently Recognized Species of Crataegus in Eastern Canada and New England.' He adds a number of new species to the already very long list of recently separated forms.

ANOTHER PHYTOBEZOAR.

SOME time ago there came into my possession a ball about ten centimeters in diameter,

which was taken from the stomach of a hog in October, 1899. This was one of several similar balls. When it came into my possession it had been somewhat compressed, so that it was somewhat cuboidal in form. Evidently, however, its form originally was pretty nearly spherical. From a preliminary study of the substance of the ball, I find that it consists entirely of vegetable fibers, and as far as the examination has gone these fibers appear to be those of alfalfa (*Medicago sativa*).

Externally, the ball is grayish in color with darker brown spots over the surface. The interior is buff color, and the whole is quite hard. It resembles in a general way the hair balls which are so frequently found in the stomachs of cattle, but is considerably heavier. This preliminary notice is made in order to call the attention of botanists who are situated near packing-houses where swine are killed to the possibility of finding more of these curious formations. A careful examination will be made of the fibrous material composing the ball, and a full report then published. Photographs have been taken of the ball, and these will be reproduced when the investigation has been completed.

Charles E. Bessey.
University of Nebraska.

MEMORIAL OF THE LATE WALTER REED.

On the fifteenth of August a meeting was held in Bar Harbor of friends of the late Major Reed, M.D., U.S.A., to whom in a large degree is due both the discovery of the mode by which yellow fever has been spread, and also the consequent suppression of that dire disease. Representative men were present from different parts of the country and letters were received from various members of committees already appointed to promote the collection of a memorial fund in grateful commemoration of Dr. Reed's services. Important suggestions were presented from President Eliot, Dr. W. W. Keen, Professor J. W. Mallet and others. Dr. Daniel C. Gilman, chairman of a committee appointed by the American Association for the Advancement of Science, presided, and Dr. Stuart Paton acted as secretary. Among those who took part in the conference were Dr. W. H. Welch, of Baltimore; Dr. Janeway, of New York; Dr. Abbott, of Philadelphia; Dr. Herter, of New York; Dr. Barker, of Chicago; Dr. Putnam, of Buffalo; Dr. Fremont Smith, of Bar Harbor; and Dr. Sajous, of Philadelphia; and besides these medical gentlemen, Bishop Lawrence, of Massachusetts, and Messrs. Morris K. Jesup, president of the New York Chamber of Commerce; John S. Kennedy, president of the Presbyterian Hospital of New York, and William J. Schieffelin, of New York. The following conclusions were reached: that an effort should be made to raise a memorial fund of $25,000 or more, the income to be given to the widow and daughter of Dr. Reed, and after their decease the principal to be appropriated either to the promotion of researches in Dr. Reed's special field, or to the erection of a memorial in his honor at Washington. Arrangements were made for the publication of circulars explaining this movement, and asking cooperation not only from the medical profession, but from all liberally disposed individuals who appreciate the value of Dr. Reed's services to mankind.

SCIENTIFIC NOTES AND NEWS.

The American Chemical Society will hold its next meeting in Convocation Week in conjunction with the meeting of the American Association for the Advancement of Science.

Dr. Emil Tietze, director of the Imperial Geological Institute of Austria, was chosen president of the Ninth International Geological Congress, which opened at Vienna on August 20.

Dr. E. von Leyden, professor of pathology at the University of Berlin, celebrated the fiftieth anniversary of his doctorate on August 11.

Dr. R. Lydekker, F.R.S., has been elected a foreign member of the Accademia dei Lincei of Rome.

The Botanical Gazette states that Mr. C. G. Lloyd, of Cincinnati, has been elected a member of the German Botanical Society and of the Botanical Society of France.

MR. CHARLES J. BRAND has been appointed to an assistant curatorship in the Department of Botany of the Field Columbian Museum.

DR. NICOLAS LEON, archeologist and ethnologist of the National Museum of Mexico, has returned to the City of Mexico after a visit to the state of Coahuila, where important excavations are being conducted.

THE daily papers state that Dr. Nathan A. Cobb, pathologist of the department of agriculture of New South Wales, has declined the position of chief of the Philippine Agricultural Bureau, giving as his reason his intention of shortly returning to the United States.

WE learn from the *Botanical Gazette* that Homer H. Foster, professor of botany in the University of Washington, has resigned in order to take up commercial work in connection with a hardwood lumber firm in Chicago.

Nature states that Mr. A. S. le Souef has been appointed director of the Zoological Garden at Sydney in succession to the late Mr. Catlett. Mr. Dudley le Souef, his elder brother, has been director of the Zoological and Acclimatization Society at Melbourne for several years, and a younger brother is director of the newly established garden at Perth, in Western Australia.

THE Commission of Inquiry into the educational systems of the United States in their bearing upon commerce and industry, projected last year by Mr. Alfred Mosely, C.M.G., but postponed owing to the unsettlement over the education bill, will start from Southampton on October 3, Mr. Mosely himself preceding it by two or three weeks to make arrangements for its reception. The commission consists of about thirty members including Professor W. E. Ayrton, Professor Magnus Maclean and Dr. W. H. Gaskell.

DR. GUSTAV STEINMANN, professor of geology at Freiburg, accompanied by Baron Bistram and Dr. Hoek, have started on an expedition to the Bolivian Andes.

IT is stated in *Nature* that for the study of bird migration, Mr. W. Eagle Clarke, assistant keeper in the Natural History Department of the Edinburgh Museum of Science and Art, has obtained permission from the Elder Brethren of Trinity House to spend a month upon the Kentish Knock Lightship, situated off the mouth of the Thames, and about twenty-one miles from the nearest point of land. The position of the vessel affords exceptional opportunities for observing the east and west autumnal movements of birds across the southern waters of the North Sea.

DR. MARTIN KELLOGG, president of the University of California from 1890 to 1899 and previously professor of Latin, has died at the age of seventy-five years.

DR. FREDERICK LAW OLMSTED, the eminent landscape architect, has died at the age of eighty-one years.

THE death is announced of M. Meunier Chalmers, the French geologist and paleontologist, professor at the Sorbonne.

NEWS has recently been received of the death, in Paraguay, of Signor Guido Boggiana, a young Italian explorer and man of science. He was murdered by the Chamacoco Indians, and his notes and photographs were destroyed.

THERE will be a civil service examination on October 21 and 22 to fill fourteen vacancies in the position of civil engineer in the Philippine service with salaries ranging from $1,400 to $1,800 a year.

THE French Association for the Advancement of Science held its annual meeting at Angers last month under the presidency of M. Emil Levasseur, the eminent economist.

THE International Geodetic Association met from August 4 to 14 under the presidency of General Bassot, of the Institute of France.

M. ROUX has given the Osiris prize of $20,000, and M. Metchnikoff a prize of $1,000 that he has recently received, to the Pasteur Institute, to be used for their experiments.

PIETRO CARTONI has given $200,000 to found a sanatorium for tuberculous patients at Rome, in memory of his two sons, who died of tuberculosis.

A NATIONAL sanitary congress is to be held at Milan in 1905, on the occasion of the exhibition which we have already mentioned. The work of the congress will be divided

among the following sections: sanitary assistance; public hygiene; clinico-scientific and therapeutic; medical jurisprudence and accidents to workmen; professional interests.

At the instance of the German minister of commerce several high mining officials will shortly be sent to England to make a thorough study of the hygienic and sanitary arrangements in mining districts.

According to *Terrestrial Magnetism* the Dutch government has granted the means for a new magnetic survey of the Dutch archipelago during the years 1904–1907. During each of these years the field work is to cover two to four months, only a general survey being possible with the present means. A beginning has already been made, observations having been made on the 'tin island,' Billiton, and at some points in the neighborhood of Batavia, and it is also hoped to secure values at different stations in Java partly to obtain early information regarding the secular variation.

A daily medical journal, edited by Dr. M. W. Curran, is announced for publication, beginning in October.

Major Penton, principal medical officer of the Soudan, has written a letter to Major Ronald Ross, which the latter communicates to the London *Times*. Major Penton writes: As the prevention of malarial fever is of the utmost importance to us in the Soudan, I have recently paid two visits to Ismailia to study on the spot the measures which, on your recommendation, are now being enforced for the destruction of mosquitoes. The results have been remarkably successful. The town is practically free from mosquitoes, which only a short time ago were very abundant. Mosquito-nets can almost be dispensed with, for one can now sleep without being bitten, as I found from personal experience. The operations you recommended are in full swing. Two marshy swamps to the northeast of the town have been filled up with sand, and a third, the largest, will shortly be dealt with. It will be drained by a pipe twenty-two centimeters in diameter, to convey away the water. Other marshes to the south of the town have been filled up. At my last visit I saw a gang of 180 workmen busily employed in filling up pools, mowing the coarse grass and undergrowth and clearing the numerous small channels or branches in connection with the main canal. The foreman of works informed me that when the men first commenced operations they were much worried with swarms of mosquitoes towards evening, but that now they scarcely saw any. Coincident with the destruction of mosquitoes and other larvæ, malarial fever at Ismailia this year shows a most striking improvement. All medical officers employed there are agreed upon this. Statistics show that up to the present it is the healthiest year on record. Dr. Pressat informed me that from January 1 to June 30 of this year there were only three cases of malarial fever in hospital, against 52 for the same period last year, and that throughout Ismailia there were 569 cases of fever from January 1 to May 30, 1902 (an average year), against 72 for the same period this year. It is more than probable, moreover, that many of the cases were relapses from previous infection. Bearing in view the remarkable diminution in malarial fevers that has attended the present operations against mosquitoes, it is more than probable that when they are completed, malarial fevers will have practically disappeared.

In his report to the United States Geological Survey on the production of petroleum in 1902, now in press, Mr. F. H. Oliphant notes the following points as the most conspicuous features in the production, sale and export of crude petroleum and its products for the year 1902: The production of crude petroleum was greater than that of any previous year; there was a slight decrease in production of the Appalachian field, and a slight increase in the Lima-Indiana field; the general average price for crude petroleum was less than in any year since 1898; stocks held in the Appalachian and Lima-Indiana fields showed a considerable decrease, principally in the Appalachian field; the exports of petroleum in 1902 were less than in 1901; no new pools were discovered in 1902. The total production in the United

States of crude petroleum in 1902 was 80,894,590 barrels, as against 69,389,194 barrels in 1901, an increase of 11,505,396 barrels, or 16.5 per cent. over that of 1901, and of 27 per cent. over that of 1900. The greatest portion of the increase in 1902 came from Texas and California, the gain being 5,830,994 barrels, or 132.7 per cent. for Texas, and 5,187,518 barrels, or 59 per cent., for California, as compared with their respective productions in 1901. The increase in Indiana in 1902 was 1,723,810 barrels, or about 30 per cent. over that of 1901. Louisiana produced for the first time in 1902, the production being 548,617 barrels. The increase in the production of Kansas was 152,598 barrels, or about 85 per cent. over 1901. Kentucky and Tennessee increased their production in 1902 by 47,799 barrels, or nearly 35 per cent. Indian Territory increased 27,000 barrels and Wyoming 850 barrels as compared with 1901. The largest decrease in production in 1902 as compared with 1901 was in West Virginia, where it amounted to 663,781 barrels, or about 4.5 per cent.; and Ohio, in its two fields, showed a decrease of 633,852 barrels, or nearly 3 per cent. The decrease in Pennsylvania was 561,498 barrels, or 4.5 per cent.; in New York, 86,888 barrels, or about 7 per cent.; in Colorado, 66,218 barrels, or about 14 per cent. The percentage of production by fields shows a remarkable change from 1900 to 1902. In 1900 the percentages were: Appalachian field, 57; Lima-Indiana field, 34; all other fields, nearly 9. In 1902 the respective percentages were: Appalachian field, 39; Lima-Indiana field, 29; all other fields, about 32. The value of the crude petroleum produced in 1902 was $69,610,384, or 86 cents per barrel, that for 1901 having been $66,417,335, or 95.7 cents per barrel, a decrease of 9.7 cents per barrel, or 10 per cent., in 1902. The gross amount received for the total product in 1902 was only $3,193,013 greater than that in 1901, although the increase in output was about 16.5 per cent. greater.

A CORRESPONDENT writes to the London *Times* that the monthly general meeting of the Zoological Society, held on August 20, was of considerable importance, inasmuch as it settled future practice in matters about which there had been some doubt—the appointment by the council of members of their own body to official posts, and their engagement for special work, partly literary and partly scientific in its character. When the reorganization committee submitted its recommendations to a general meeting at the end of last year it was resolved to ask Mr. de Winton to undertake the post of superintendent, vacant through the resignation of the late Mr. Clarence Bartlett on account of ill-health, and to carry out the reorganization of the gardens. That gentleman accepted the charge, and since his appointment had done a good deal, not only in improving the gardens, but in cutting down expenses. The council found that the time allotted was too short to allow of his carrying out what had been planned, and, on being invited, he consented to accept the post for a second year. But, acting under legal advice, the council felt bound to submit the matter, with some others, to the decision of a general meeting. Dr. Guenther, who presided, accordingly put an official motion, of which due notice had been given, to the effect that the appointment should continue during 1904 with emoluments at the rate of £400 a year and an official residence in the gardens. The chairman spoke warmly in favor of the motion, as did Dr. Henry Woodward, Mr. Oldfield Thomas and Mr. Bowes. Major Cotton did not oppose the motion, but urged the desirablity of seeking a candidate outside the ranks of the council, and Professor Cunningham was of opinion that it would be desirable to have a decision as to whether members of council should be eligible for paid posts. The chairman admitted that the appointment was only a temporary one, made at a critical period in the history of the society. On being put from the chair, the motion was carried unanimously. Other motions dealt with payments for work done by two members of council—Dr. Sharp, as editor and recorder, and Mr. Boulanger, as recorder, for the *Zoological Record*, which gives titles and brief abstracts of zoological literature all over the world, and is published by the society

yearly. Dr. Henry Woodward and Mr. Oldfield Thomas explained the nature of the work, which can only be done by men of considerable scientific attainments and linguistic skill. Professor Cunningham suggested that the appointment of recorders in the different subjects should rest with the editor, and not with the council, to which the reply was that, as the editor was paid a merely nominal sum for his services, it would be unfair to impose this additional labor on him. The motion was carried without a dissentient, and the meeting adjourned to November 19.

The Geographical Journal states that a preliminary report has been received from the leader of the second expedition sent out to Brazil by the Royal Academy of Sciences of Vienna. After landing at Pernambuco, two excursions were made by rail to the neighborhood of Berberibe and Pas d'Alho, which gave a foretaste of the enormous wealth of bird-life in those tropical regions. A similar impression was made by excursions round Bahia, to Cabula, Rio Vermelho, the neighborhood of Barra near the Bahia lighthouse, and even on the outermost slopes, covered with vegetation, between the east of the town and the sea. Here was first seen the *Wistiti* (*Hapale Jacchus*), which is peculiar to Bahia and Pernambuco. On the journey to the Rio Sao Francisco extensive ornithological collections were made; a week was spent at Joazeiro, on the right bank of the great river. An imposing representative of the bird world here is the Nandu, or Ema (*Rhea macrorhyncha*). The characteristic mammals of this region are the armadillo (*Dasypus*), pouched rat and ant-eater. Fish are abundant in the river, but there are not many species. The Pirá (*Conarhynchus conirastris*), with a long curved tube-shaped snout, and Pacrí (*Myletes*), with a shark's mouth, are remarkable, being of larger size than most of the others. Hofrath Steindachner expects a particularly rich yield of fishes characteristic of the region from the stay at Barra, where the Rio Grande flows into the Sao Francisco. Lacertilians are represented in the neighborhood of Joazeiro by eight or nine species, including a very delicate dark-striped Scincoid with a blood-red tail. Most of the small variegated or dark-colored snakes of this region are said to be poisonous. The Ema mentioned above is greatly valued as a destroyer of snakes, and is kept on the haciendas. The kites do their utmost in destroying animal 'undesirables,' and enjoy the greatest favor all over the country. The whole bird-life of the Joazeiro district resembles that of the Amazon region more closely than that of southern Brazil. In the middle of March the desolate solitudes of the bush were explored, starting from the railway at Carnahyba, and a nearly complete collection of the birds, consisting of some fifty specimens, was made. The most characteristic representatives are five species of pigeons and two of parrots.

UNIVERSITY AND EDUCATIONAL NEWS.

Mrs. Cyrus H. McCormick and her three sons, of Chicago, have given $10,000 to Washington and Lee University, the interest of which is to be devoted to the development of the department of physics. A new laboratory of engineering and physics, the gift of another friend in Chicago, whose name is for the present withheld, is expected to be ready for occupation next summer.

Dr. Johann Hjort and others offer courses of instruction on marine investigations at Bergen during the months of September, October and November. There is no charge for the courses which include lectures, laboratory work and field work.

Mr. C. F. Baker has been appointed assistant professor of biology in Pomona College, Claremont, Cal.

Dr. O. Schmidt and Dr. Julius Meyer have qualified as docents in chemistry in the universities of Bonn and Breslau, and Dr. R. Gans and Dr. Kohl as docents in physics in the universities of Tübingen and Vienna, respectively.

Dr. R. Brauns, professor of mineralogy at Giessen, has been elected rector for the coming year.